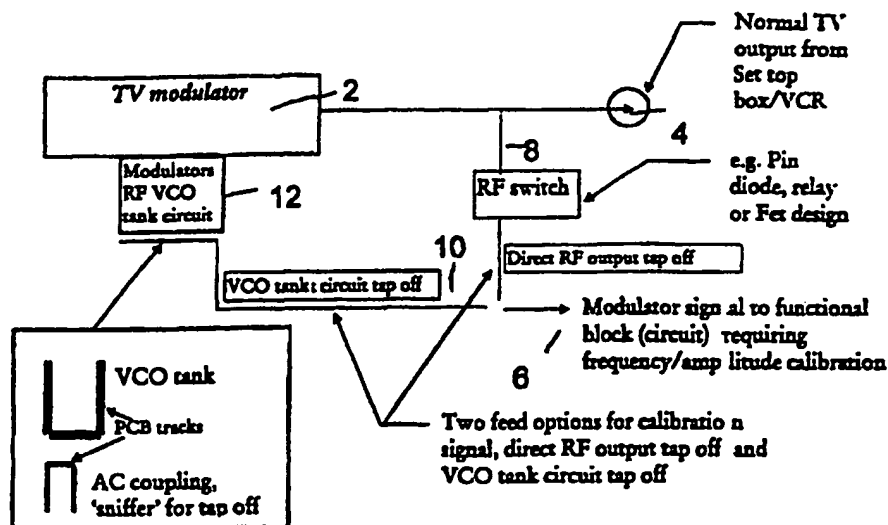




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: FREQUENCY ADJUSTMENT



(57) Abstract

The invention to which this application relates is to provide a means for use in electrical and electronic apparatus, such as apparatus for the receipt of television signals in either analogue or digital form, and to allow components within the apparatus which are required to operate at set frequencies or within set frequency range, to be set and/or adjusted prior to, or during, use of the apparatus with reference to an RFTV modulator. This ensures that the components are set and maintained within predetermined parameters and also overcomes the need for additional time in the manual setting and/or adjusting of the devices and/or the provision of additional components to prevent frequency drift as is the case in conventional apparatus.

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## Frequency Adjustment

The invention which is the subject of this application relates to the ability to adjust and calibrate the frequency adjustable component parts of a piece of apparatus used in the reception and/or handling of signals relating to television broadcast systems and in particular, but not exclusively, to a range of devices such as satellite signal reception devices, terrestrial or radio signal reception devices, cable signal reception devices and in general digital and analogue television signal reception devices and video cassette recorders and hereinafter collectively referred to as set top devices.

In set top devices a number of devices or components are required to be set to operate at specific frequencies or frequency ranges. For example, the set top device is provided with an RF TV modulator which is used by a television set connected to the RF O/P of the set top device to receive signals processed by the set top device. Conventionally, these modulators had relatively poor frequency stability and could tend to drift over time, or be adversely affected by knocks or bumps to the set, variation in temperature and the like. Furthermore, the frequencies were typically factory set and set to a wide range so as to attempt to overcome the problems with the lack of stability. However more recently the RFTV modulators have included phase lock loop VCO design which has enabled the same to be electronically frequency and amplitude adjustable, and for the stability and control of the same to be considerably improved.

In set top boxes, there are provided components which are also required to be set to operate within specific frequency ranges. At the present time, these frequency ranges and/or amplitude levels are factory set so that the set top box manufacturing process includes a time for the setting of the frequency and amplitude of said components. Again the frequency and amplitude to which the

components are set can drift over time, due to temperature changes, shock and /or bump and so the components are set to relatively wide frequency ranges in an attempt to reduce the problems that this drift can cause and in some instances can require the set top box being returned to the manufacturer or repair outlet for the frequency settings to be readjusted to enable the set top box to be used. This is undesirable to the customer and indeed to the manufacturer in the time required to initially set and then possibly repair the same. A further disadvantage with set top box frequency adjustable components is that the same are manually adjustable and temperature or shock compensation components are included. This again adds to the time of manufacture and expense in labour at least as mechanically adjustable electronic components such as potentiometers which are typically included are required to be potted and the mechanical stability of the same is also a problem.

The aim of the present invention is to provide a set top box device which has a means to allow the frequency components of the device to be automatically set to the required frequency or frequency range for operation. It is also a further aim to provide a means whereby, during use the frequency or frequency range of the frequency components is checked and if required adjusted.

In a first aspect of the invention there is provided a set top box for use in conjunction with a television set, and including at least one component which is required to be set to a specific frequency or frequency range for operation and wherein the component is automatically adjustable to the required frequency or frequency range with reference to an RF TV modulator generated signal.

Typically the RF TV modulator referred to is that which is used in a set top device as a Radio Frequency Television signal generating device.

Typically the RF TV modulator in the set top device incorporates a phase lock loop VCO design and is capable of output signal frequency and amplitude adjustment via control software.

As the frequency of the component or components of the set top signal device is automatically adjusted with reference to an RF modulator, it will be appreciated that the need to manually set the components during manufacture of the set top box is overcome and thus there are considerable time savings achieved in the manufacturing process.

In a second aspect of the invention there is provided a set top box for use with a television set, said set top box including at least one component which is set to operate at a frequency or frequency range and an RF modulator set to operate at a specific frequency or frequency range and wherein said RF modulator is operated to generate a reference signal indicative of the frequency setting, said signal referred to by the control means for the set top box to set the at least one component to operate at the said frequency or frequency range.

In one preferred embodiment the control means for the set top device refers to the signal from its RF TV modulator at predetermined intervals during use of the set top device and/or on every occasion when the set top device is switched on for use. Thus it will be appreciated that in addition to the use of the signal from its RF TV modulator to act as a datum to which the at least one component in the set top device is initially set, the signal can also be used as a reference during use of the set top device. This can allow temperature and shock compensation components which are manually adjustable components currently included in set top devices to be removed as the continued checking of the frequency

settings for the component or components of the set top devices ensures that the same do not drift outside acceptable tolerances.

In one preferred embodiment it is envisaged that the control means for the set top device will be set to refer to the signal from the RF TV modulator every time the device is switched on and also on every time a channel change is made to the set top device and/or on every occasion a function change is made to the set top device. The advantage of making the check every time there is a function change is that there will be no alteration to the picture viewed due to the check as this is masked by the function change.

If, upon checking the frequency and/or amplitude of the at least one component has been found to have changed then the control means will alter the frequency and/or amplitude setting to bring it back within the predetermined tolerances.

In one preferred embodiment the set top device includes a memory which holds information relating to the results of a predetermined number of previous checks and in one embodiment the control means will compare the current frequency setting of the component with the previous setting rather than the signal from its RF TV modulator and may then only refer to its signal from the RF TV modulator at longer intervals such as once a day, week or the like. The ability to store previous check results may also be used as an indicator to a fault if there is a need to repair the set top device.

The RF TV modulator of the set top device can also be used as a modulated source e.g. QPSK/QAM etc and used to calibrate components in a digital set top device and this is another aspect of the invention.

Specific embodiments of the invention will now be described with reference to the accompanying drawings wherein;

Figure 1 illustrates a general diagram of a circuit according to the invention;

Figure 2 illustrates a specific embodiment of the invention; and

Figure 3 illustrates a further embodiment of the invention.

Referring firstly to Figure 1 there is shown a circuit diagram which illustrates the main feature of the invention and comprises a set top device, RF TV modulator 2 with connections to a television set 4. The modulator 2 is used to generate a signal indicative of the frequency setting of the same and said signal can be obtained for use within the set top device to allow the setting of a component or components 6 in the set top device. In the diagram there are shown two ways in which the signal is received and these are by the tap 8 from the TV output or alternatively a tap 10 from the RF VCO circuit 12 of the TV modulator 2.

Figure 2 illustrates a specific example in which the FM demodulator 14 of the satellite receiver set top device 16 is required to be frequency set and/or subsequently checked during operation. In the first instance and at spaced intervals thereafter the connection 17 to the TV Modulator 18 can be completed upon a signal from the control means 20 for the set top device and when complete a signal from the TV modulator is received. This signal is indicative of the frequency setting and the FM demodulator of the satellite receiver is set to operate at the required frequency accordingly. In between references to the signal from the TV modulator, the frequency of the FM demodulator can be checked with reference to a memory with the set top device and the control means 20 is used to refer the

current frequency setting with the previous setting or an average of the previous settings and adjust the current setting if required. Thus it will be appreciated that the references to the television modulator signal may be less frequent than the number of checks on the frequency setting of the set top box component or components.

A further feature of the invention is shown in Figure 3 wherein there is shown a set top box with an FM demodulator IC 26 connected to a bias control 28 from the control means and a video feed for FM modulation of the input signal. As it is possible to alter the voltage bias point of the FM modulators VCO varactors this alters the nominal tuned centre frequency of the VCO. Thus it is possible to realign a VCO that has drifted off the required centre frequency by adjusting the centre frequency in response to monitoring of the AFC condition, which is typically a voltage level indicating frequency difference between the VCO centre frequency and that of the IF input frequency, and adjusting the VCO varactor bias voltage until a required (zero point) voltage is set on the AFC output.

Thus it will be appreciated that the apparatus and method according to the present invention represents considerable advantages to the consumer and user of the set top devices described as it allows the operating parameters of the same to be maintained within the specified and optimum tolerances and, furthermore offers savings to the manufacturers of the set top boxes in terms of reduction of labour time in the manufacture of the same due to the ability to auto set the components rather than manually set, a reduction in the additional mechanical components required to be included in the set top devices and a reduction in the repairs necessary to set top devices.

## Claims

1. Electrical apparatus including at least one component which is required to be set to a specific frequency or frequency range for operation and wherein the component is automatically adjustable to the required frequency or frequency range with reference to an RFTV modulator generating signal.
2. Electrical apparatus according to claim 1 wherein the electrical apparatus is a set top box for use in conjunction with a television set or other form of display screen.
3. Electrical apparatus according to claim 1 wherein the RFTV modulator is used in a set top device as a radio frequency television signal generating device.
4. Electrical apparatus according to claim 3 wherein the RFTV modulator incorporates a phase lock loop VCO design and is capable of output signal frequency and amplitude adjustment.
5. Electrical apparatus according to claim 4 wherein the output signal frequency and amplitude adjustment is performed via control software or processing system within the electrical apparatus.
6. A set top box for use with a television set, said set top box including at least one component which is set to operate at a frequency or frequency range and an RF modulator set to operate at a specific frequency or frequency range and wherein said RF modulator is operated to generate a reference signal indicative of the frequency setting, said signal referred to by control means for the set top box to set the at least one component to operate at the said frequency or frequency range.

7. A set top box according to claim 6 wherein the control means refers to a signal from its RFTV modulator at intervals of time.

8. A set top box according to claim 7 wherein reference is made to the RFTV modulator at predetermined time intervals during use of the set top box.

9. A set top box according to claim 7 wherein reference is made to the RFTV modulator upon the change in function or channel of the set top box.

10. A set top box according to any preceding claims wherein the same includes a memory which holds information relating to the results of a predetermined number of previous references to the RFTV modulator reference signal.

11. A set top box according to claim 10 wherein reference is made to the results held in the memory at intervals of time in addition to or instead of reference to the RFTV modulator.

12. A set top box device for use with a television set or display screen, said set top box including at least one component which is set to operate at a frequency or frequency range and an RF modulator wherein the RF modulator is used as a modulated source to calibrate components included in a set top box device for the receipt and processing of digital data.

13. A set top box device according to claim 13 wherein the RFTV modulator is used as a QPSK/QAM device.

Figure 1

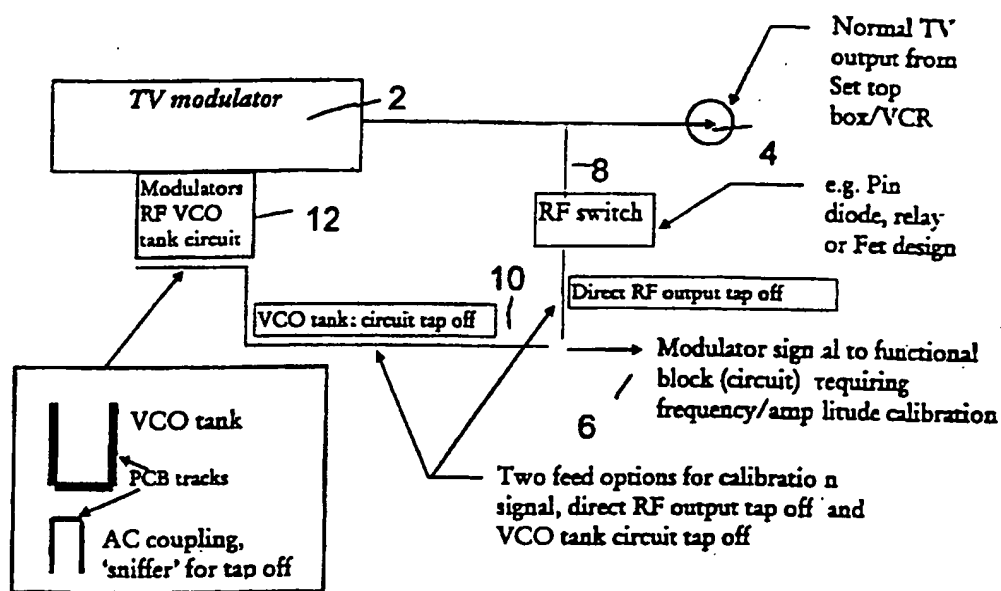
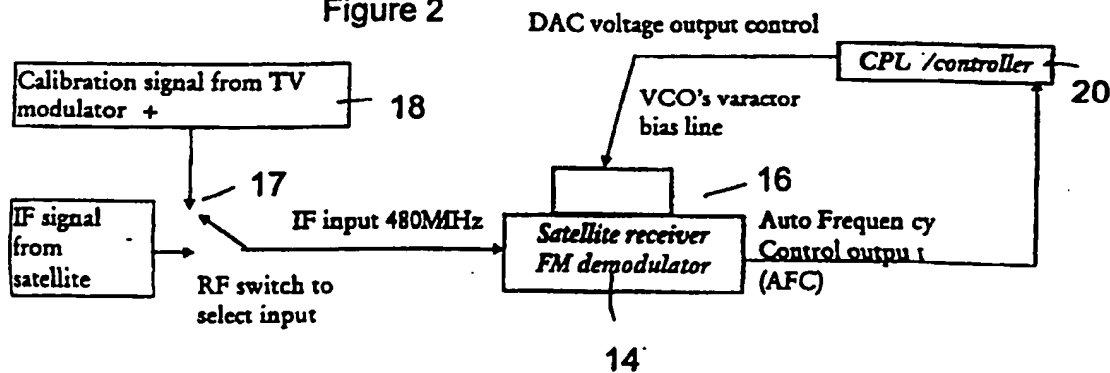
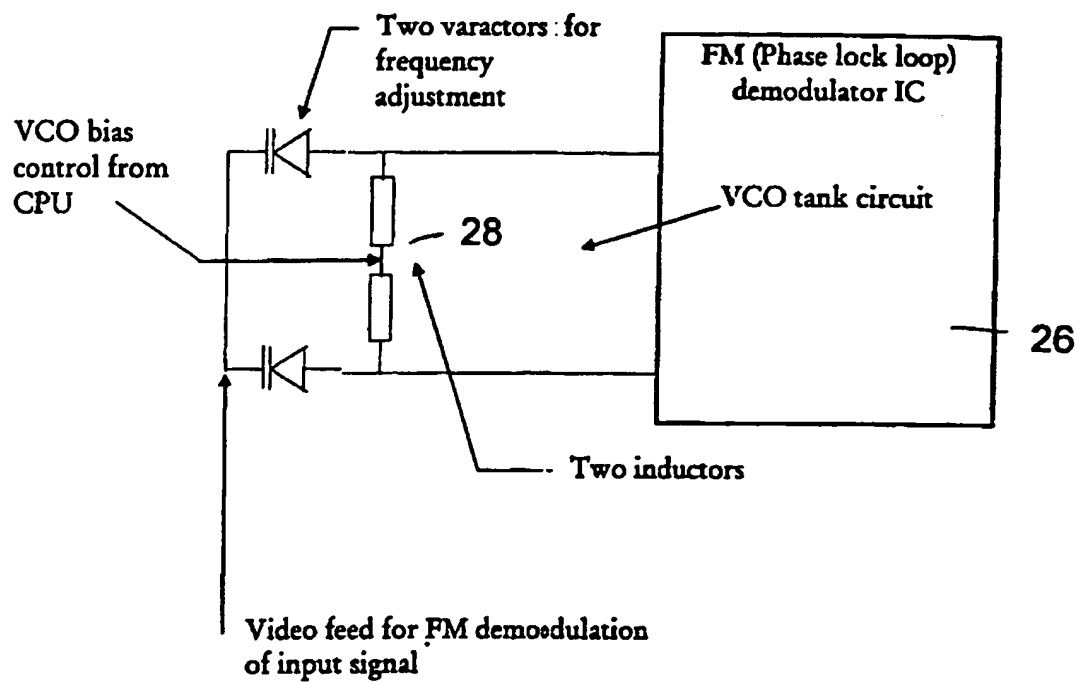


Figure 2



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Figure 3



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02031

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H03J7/02

According to International Patent Classification (IPC) or to both national classification and IPC

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IPC 7 H03J H04N

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92 17010 A (SCIENTIFIC ATLANTA) 1 October 1992 (1992-10-01) page 17, line 8 -page 19, line 28; figures 4,5	1-12
X	US 4 556 988 A (YOSHISATO AKIYUKI) 3 December 1985 (1985-12-03) the whole document	1

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